



SATURN—PHOTOGRAPHS SHOWING THE OPEN PHASE OF RINGS

Photographs made by Barnard with the 60-inch reflecting telescope at Mt. Wilson Observatory, California, November 19, 1911

OUR PLANET NEIGHBORS

By HAROLD JACOBY

Professor of Astronomy, Columbia University

MENTOR GRAVURES

MOUNT WILSON SOLAR OBSERVATORY, NEAR LOS ANGELES, CAL. · REFLECTING TELESCOPE, MOUNT WILSON OBSERVATORY · YERKES OBSERVATORY, WILLIAMS BAY, WIS. · YERKES TELESCOPE, YERKES OBSERVATORY · LICK OBSERVATORY, SUMMIT OF MOUNT HAMILTON, NEAR SAN JOSÉ, CAL. · MOON IN ITS FIRST QUARTER



WHEN we look up at the great round dome of the sky on a clear night, and see it studded with stars, seemingly countless, we always feel a great curiosity to know which are the famous planets of our solar system. For we have all heard, and we have all been deeply interested in hearing, that there is a solar system, a system of planets revolving around the sun in paths or orbits closely resembling circles. We have also heard that our earth, the solid earth beneath our feet, is really only one of these planets of the solar system, and is, like the others, traversing its duly appointed path around the sun, year after year, and age after age.

How can we know which are the planets, among the myriad stars of night? There are various ways to distinguish them, and of these perhaps the easiest is to take advantage of their brilliancy, a brilliancy so great as to be superior to the brightest of the other stars. And why are the planets so bright? The earth is not bright, and yet it is a planet. This is a puzzling question, very often asked of astronomers. And astronomers as often answer the question: for kindly souls are they, who love to talk and write about their hobby, and are always happy if they can find readers or listeners who will question them.

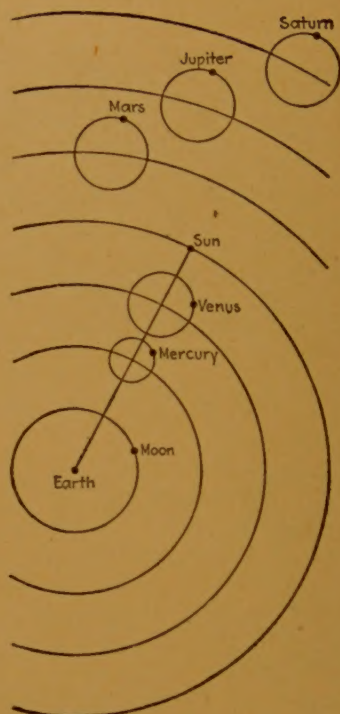
OUR PLANET NEIGHBORS

How Planets Are Seen

The planets *seem* bright, but they are not really self-luminous. We see them only when they are illumined by the sun. We see the planet Mars, for instance, in the same way, and by the same process, which enables us to see a book in a library at night. An electric light in the library illumines the book and makes it visible. In just the same way do we see Mars; only, instead of an electric light, it is the sun that illumines the planet. More accurately stated, the process of seeing is as follows: light from the electric bulb falls on the book, or light from the sun falls on Mars, and in each case the light is reflected back, and travels to the observer's eye. In the case of the book it has but a short distance to travel; in the case of Mars a very long distance, but the principle is the same.

Now it may seem strange that a book can reflect like a mirror; but it is a fact. The mirror, of course, reflects much better: it has a highly polished reflecting surface, especially designed for turning back any light that falls on it, and it does actually reflect nearly all the light that it receives. A book or a planet, on the other hand, has no polished surface; it reflects only a small part of the light that falls on it; yet even this small part is quite enough to make it visible.

These considerations enable us to understand why Mars is so bright and the planet Earth so dull. Both planets are seen by reflected sunlight, and both probably have surfaces of similar reflecting power. But Mars is seen at night only: and when thus seen at night, the sky being dark because of the absence of daylight, we see Mars against an absolutely black or lightless sky background, and so the effect of extreme contrast makes it appear excessively bright. The earth, seen in daytime, is of course contrasted with bright daylight, and this is the reason the earth seems comparatively so dull. At night we cannot really see the earth at all, because at night, for an inhabitant of the earth, the sun is below the horizon, and so the



THE PTOLEMAIC PLAN

According to Ptolemy, the earth was the center of the universe, and the other planets and sun circled about it



COPERNICUS (1473-1543)

Founder of modern astronomy. He discovered the correct scheme of the solar system

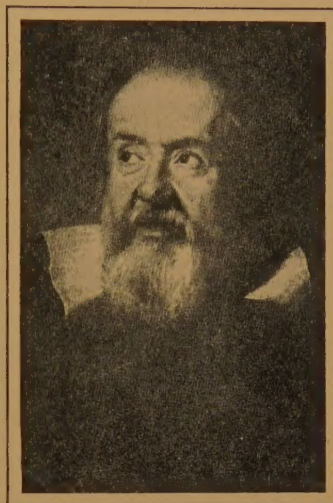
OUR PLANET NEIGHBORS

earth, at the point where the observer stands, receives no sunlight, is not illumined, and is therefore invisible.

With this understanding of the cause of planetary visibility, it is clear that the degree of luminosity will always depend on the degree of brightness of the sunlight, and also on the relative nearness of the planet to the earth. Both these factors are favorable. The sun is a most powerful illuminator, and the planets are all near the earth, speaking astronomically. That is to say, moving as they do in orbits around the sun, they are all necessarily near the sun, and therefore also near each other, as compared with the distances of the other stars of night. These other stars are located in space at distances incomparably vaster than those that separate the planets; and though these other stars are self-luminous, and do not need to depend on the less favorable condition of reflection for their brightness, the factor of distance still prevents their being as luminous as are the planets.

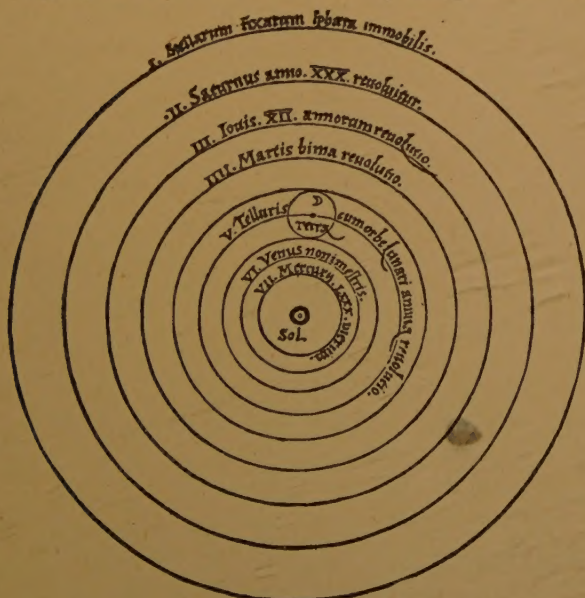
To take advantage of this superior brightness to identify the planets, it is merely necessary to look for them in the dusk of twilight, when the sun has just passed below the horizon, but still lights

the upper air enough to leave considerable brightness in the sky background. Then, as the sun continues to go down, the sky background will become slowly darker, and of course the first objects to be seen in the gathering darkness will be the brightest ones, the planets. If there is a planet above the horizon, it will appear in the dusk first of all; it will justify the name given it by men of old; it will be the evening star. And since the same observation can also be made in the morning twilight before sunrise, it follows that the morning stars and the evening stars are always planets.



GALILEO GALILEI (1564-1642)

Famous Italian astronomer who insisted that the earth moved. He discovered the moons of Jupiter, sun spots and other objects in the heavens



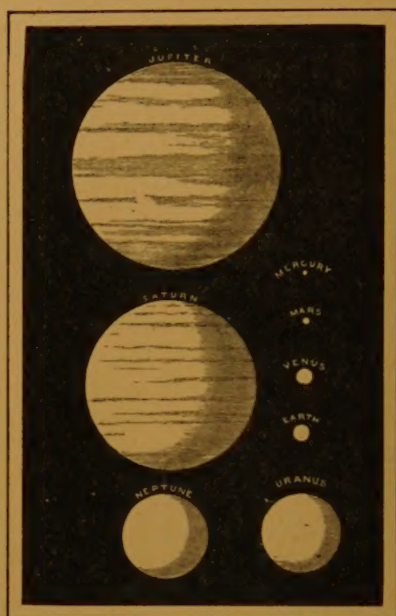
THE COPERNICAN PLAN

The sun in center, then in orbits around it, in the order of their distance: Mercury, Venus, Earth (with moon in small circle), Mars, Jupiter, and Saturn. The outer circle stands for "the motionless sphere of the fixed stars."

OUR PLANET NEIGHBORS

Orbits of Planets

The kind of orbits in which the planets move around the sun are shown in the diagram on page 3, which is reproduced from Copernicus' book "*De Revolutionibus Orbium Cœlestium*," published in 1543. The diagram shows the sun (Sol) at the center, with concentric circular planetary orbits around it. The earth (Terra) has a little circle accompanying it, to represent the orbit in which our moon travels about the earth. The moon is itself shown as a small crescent. This diagram is especially interesting because it is the very one by which our present accepted theory of planetary motion was first demonstrated to mankind by Copernicus of old. The still more ancient theory of Ptolemy, now discarded, is shown in another diagram. In this theory the earth was supposed to remain immobile at the center of the solar system, and the sun as well as the planets circulated around it. The sun moved in a true circle, but the planets traversed smaller secondary circles, which in turn moved upon larger circular orbits. This very complicated theory, as already stated, has been quite abandoned, but it is still of interest, as showing what radical changes supposedly well-proved scientific theories sometimes undergo.



COMPARATIVE SIZES OF THE PLANETS



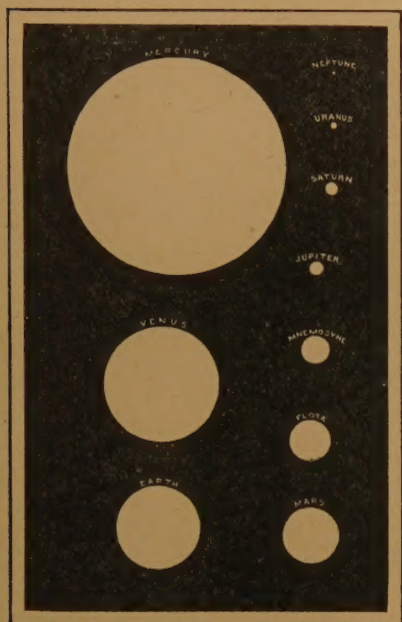
JOHAN KEPLER (1571-1630)

German astronomer who discovered the laws that determine the orbits of the planets

Venus and Mercury

The Copernican diagram further shows that two planets, Mercury and Venus, pursue orbits smaller than that of the earth. Even when compared with the other planets, and not with the stars, they may be said to be always especially near the sun. Therefore, when we look at them in the sky, they are always seen very near the sun. This makes it difficult to observe them, and the difficulty is much greater in the case of Mercury than in that of Venus, because Mercury is nearest of all to the sun. The reason a planet is difficult to see when near the sun is simple. Being near each other in the sky, it is probable that both sun and planet will be above the horizon at the same

OUR PLANET NEIGHBORS



RELATIVE APPARENT SIZE OF THE SUN
AS SEEN FROM THE DIFFERENT PLANETS

time. If so, the sun will cause daylight, and this will quite overpower the planet, and render it invisible.

To make the planet visible, it is necessary that it be above the horizon while the sun is below. Now as Venus and Mercury go around the sun, they will sometimes appear above that luminary in the sky, and sometimes below it. Therefore, if we make our observations in the evening twilight, just after sunset, at a time when Venus or Mercury happens to be above the sun, we shall see the planet in the twilight sky, just above the point where the sun has set. It will still be near the sun; the small size of the orbit compels it to be near; but it will be visible, because the major part of the sun's light disappears soon after sunset.

If a similar observation be attempted in the morning twilight, it must be made at a time when the planet, by reason of its orbital motion, is on the side of the sun

opposite its former position. If the planet is properly placed for the evening observation, so that the sun sets before the planet, it will also rise in the morning before the planet, and so there would be full daylight when the planet makes its appearance at the eastern horizon. For the morning observation it is necessary, on the contrary, to have the planet rise first, so that it may be seen in the twilight before the sun comes up. It will of course be seen just above the point where the sun is about to rise.

Mars, Jupiter and Saturn

The three other planets visible to the unaided eye are Mars, Jupiter and Saturn. These have orbits much larger than the earth's orbit; and a little consideration of the Copernican diagram shows that they may at times be so located that the earth will lie, more or less accurately, directly between the planet and the sun. When this occurs, sun and planet will be seen from the earth at directly opposite positions in the sky. This is the most favorable opportunity to observe them; for since they are opposite each other, the sun will set when the planet rises, and it will rise



SIR ISAAC NEWTON (1642-1727)
English philosopher who discovered the law
of gravitation

OUR PLANET NEIGHBORS

when the planet sets. The planet will therefore be above the horizon all night. It will also reach its greatest elevation in the sky at midnight, which is a very favorable condition for good seeing.

There is still another interesting observation that can be made readily with the unaided eye, an observation also depending on the fact that all the planets are much nearer the sun than are the great mass of the stars. Because of this nearness to the sun, and consequent nearness to the earth, we can see their orbital motions, whereas in the case of the other stars, orbital motions, if such exist, shrink into nothingness on account of the enormous distances by which we are separated from them.

The effect of our thus seeing the planetary motions, and not the stellar motions, is to make the planets seem to wander around in the foreground of the sky, as it were, while the stars are apparently fixed in the background. This explains the names *planet* and *fixed star*. The name planet signifies wandering star; and all the planets, as they progress around their orbits, can be plainly seen to wander among the fixed stars. These wanderings cannot be detected with the unaided eye in a single night, but they are always easily perceptible after the lapse of a few weeks.

Sizes of the Planets

Having thus explained the conditions of planetary visibility and planetary motion, let us now consider certain other matters of general interest. The comparative sizes of the planets are well shown in the accompanying illustration; and it will be perceived that Jupiter is the giant member of the solar system. The small planets are all near the sun, Mercury being nearest of all. It follows that the sun would look very large, if it were seen from Mercury. Being so near, it would



FULL MOON



JUPITER HALF HIDDEN BY THE MOON



Photo by Barnard
CRESCENT MOON

OUR PLANET NEIGHBORS

lose the diminution of size that always results from a long distance observation. Another illustration shows this relative apparent size of the sun, as it would be seen from the different planets; and this again, remembering that proximity means apparent increase of size, gives an idea also of the relative planetary distances from the sun, as already explained for the Copernican diagram.



VENUS AND SATURN
As seen Dec. 19, 1845

The two planets Mnemosyne and Flora, mentioned in the illustration, require special explanation. They belong to a group of bodies called Minor Planets. Several hundred of these little objects have been discovered since the beginning of the nineteenth century. They are very tiny planets, and all move in orbits situated between the orbits of Mars and Jupiter.

The latest method of discovering these minor planets is photographic. It is merely necessary to expose a photographic plate for a couple of hours with a large photographic telescope. Then if there is a minor planet within the area of the sky corresponding to the photographic plate, it will surely betray its presence when the negative has been developed.

Such a photograph is shown in the accompanying illustration. Two minor planets appear: they look like short lines, and they are located at two points. The planets are thus drawn out into lines on the photograph because of their "wanderings," due to the orbital motion already explained. The fixed stars, on the other hand, all appear on the plate as simple dots. Thus the presence of a line infallibly indicates a planet. Were it not for this peculiarity of wandering, it would be impossible to distinguish the minor planets from the stars.



PLANETOIDS

A long-exposure photograph shows the difference between little planets (planetoids) and fixed stars. On the photographic plate, fixed stars being so far distant, remain constant points of light. Planetoids have a "pulled-out" appearance showing that they moved during exposure of the photograph

OUR PLANET NEIGHBORS

Conjunction of Planets

Another interesting phenomenon is a "conjunction" of two planets; and the illustration on page 7 shows a very close one that occurred in 1845. Saturn and Venus were then so near each other in the sky that they could be seen together in a single telescopic field. Indeed, the word conjunction signifies a joining together. The illustration shows Saturn surrounded by its "rings," which are described elsewhere in the present number. Venus appears in the half-moon phase; and it is a fact that both Mars and Venus exhibit phases quite analogous to those of our moon.

Of course these conjunctions do not mean that the two planets are really quite close together in space. They only seem so, as seen from the earth. They are in line as we see them, but one is always far out in space behind the other. In this case Saturn is much farther away from us than is Venus.

Sometimes our own moon comes into conjunction with one of the planets. A cut on page 6 shows such a conjunction of the moon and Jupiter. Of course the moon, of the two bodies, is much the nearer to us: it is between us and Jupiter; and in the illustration is shown half covering or "occulting" Jupiter. The orbital motion of the moon is such that it soon occulted Jupiter entirely on the night the observation was made. Such lunar occultations are not excessively rare: quite a number have been recorded in the annals of astronomy.

Origin of Our Solar System

As to the origin or evolution of our solar system two plausible theories have been advanced. The first is the nebular hypothesis of Laplace. This

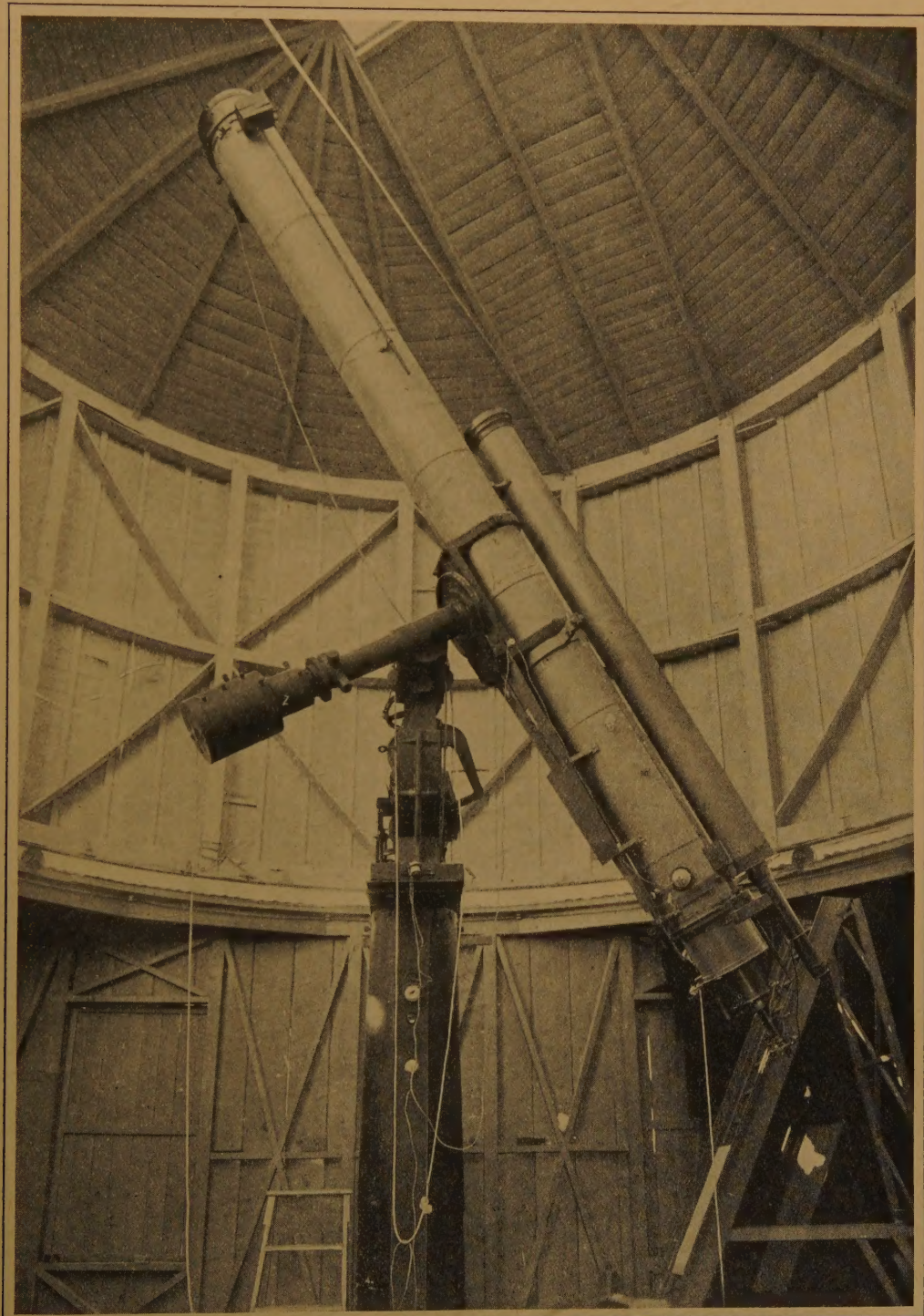


SURFACE OF THE MOON
Showing craters and valleys



MARS
Photographs showing markings
on Mars and white spots at the
poles

OUR PLANET NEIGHBORS



TELESCOPE, HARVARD OBSERVATORY, AREQUIPA, PERU

Arequipa is about 8,000 feet above the sea and is a great observation point from which to photograph the heavens. The photographic outfit here is one of the largest and most powerful in the world

OUR PLANET NEIGHBORS

astronomer supposed that the sun was once a large globular rotating "nebula," or mass of hot incandescent gas. Gradual contraction of this globe as it cooled would produce a more rapid rotation. If this rapidity of rotation increased sufficiently, and Laplace thought this really occurred at some epoch in the sun's past history, the centrifugal force would also increase near the middle of the rotating mass. This force might then be sufficient to detach a ring of matter from the nebula, and this ring might break up

through its own instability into a number of fragments. These would continue to rotate around that part of the original sun-nebula which still remained at the center; and they might gradually coalesce into a planet, which would continue to revolve around the parent sun in a circle, now become its permanent orbit. In case conditions were not favorable to coalescence, a group of minor planets might result.

The other theory is a recent one, due to Chamberlin and Moulton, and is based on an observation by Keeler, who found from an extended series of sidereal photographs that the actual predominant type of observable nebula has a spiral shape, not a spherical one. The new theory, therefore, assumes that the original form of the solar nebula was not a Laplacian rotating sphere or globe, but a vast spiral with a central hub. From the material composing the spires of this nebula the planets are supposed to have been formed by some process of coalescence and condensation, the central hub giving us finally our present sun.

But whatever may have been the exact details of this cosmic growth of our solar system, it is clear that the process is not yet ended. For the sun must still be growing gradually cooler, by radiation of its heat into space. A myriad ages may well elapse before the end; but the sun is surely fated to become finally cold, absolutely. With the loss of heat will come also loss of light; and so our neighbor planets, like our earth and ourselves, are destined for final extinction in darkness and in cold.



From "Mars," by Percival Lowell. Copyright, Houghton, Mifflin Co., Publishers

MARS

Showing the lines which are called "canals"

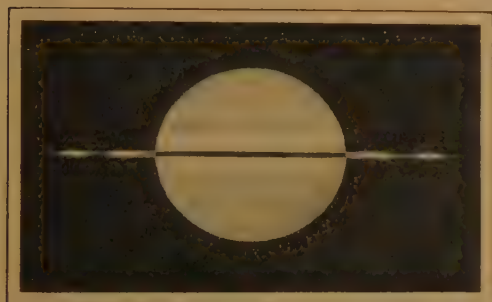
OUR PLANET NEIGHBORS

The Orbits of the Planets

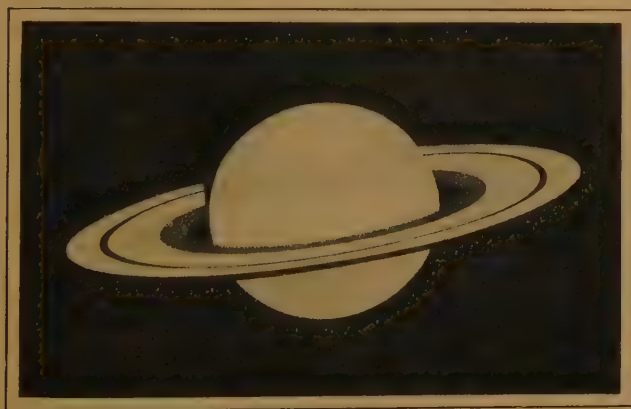
The motions of the planets are based on Kepler's Laws. Kepler was a remarkable character, given over to strange, mystic fancies, but withal, a tireless investigator of the riddles of nature and a student of extraordinary enthusiasm and industry. His laws are three in number, and were the outcome of a lifetime of speculation.

In studying the motions of the planets, Kepler began with Mars. In 1609, after much labor, he was able, as he put it, "to lead this captive planet to the foot of his throne." He established in the case of Mars his first two laws:

1. The planet describes an ellipse, the sun being in one focus.
2. The straight line joining the planet to the sun sweeps out equal areas in any two equal intervals of time.



SATURN—Dec., 1907
Showing the rings "edge on"



SATURN Showing the "open phase" of the rings

Kepler then turned to the other planets, and in time evolved the third law:

3. The squares of the times of revolution of any two planets (including the earth) about the sun are proportional to the cubes of their mean distances from the sun.

The meaning of this law is not clear to the average mind, but it is simple enough to astronomers—and very important.

Kepler's works are voluminous, and full of wild, imaginative matter. But his three laws of planetary motion are a sufficient contribution to assure him immortal fame.

The following table shows the relative time consumed by the planets in encircling the sun. Beginning with Mercury, which is nearest to the sun, the orbits grow larger and, of course, the period required to complete the circle grows longer:

Planets	Sidereal Period
Mercury	88 days
Venus	225 days
Earth	365 days
Mars	687 days
Jupiter	12 years
Saturn	30 years
Uranus	84 years
Neptune	165 years

SUPPLEMENTARY READING

STARLAND *By Sir Robert S. Ball, F. R. S.*
ASTRONOMY, A POPULAR HANDBOOK
By Prof. Harold Jacoby
PRACTICAL TALKS BY AN ASTRONOMER
By Prof. Harold Jacoby
THE SYSTEM OF THE STARS
By Agnes M. Clerke
THE FRIENDLY STARS *By M. Martin*

THE NEW ASTRONOMY *By S. P. Langley*
THE SOLAR SYSTEM *By Percival Lowell*
MARS *By Percival Lowell*
ASTRONOMY WITH THE NAKED EYE
By Garrett P. Serviss
AROUND THE YEAR WITH THE STARS
By Garrett P. Serviss

*** Information concerning the above books and articles may be had on application to the Editor

THE OPEN LETTER

There is romance in the stars. It is the attraction of one planet for another that holds them together in lasting bonds. The discovery of Neptune through his attraction for Uranus is one of the most interesting events in the history of Starland. The story is only about seventy years old. It was Uranus' behavior that betrayed Neptune and disclosed his presence. But for the infatuation that drew Uranus out of its proper course, Neptune's presence in the solar group of planets might never have been known. He might have kept his secret for all time.

★ ★ ★

Uranus was discovered in 1781 by the famous astronomer Herschel. Its orbit was determined, and it seemed to be pursuing it with steadfastness and regularity. Had Uranus really done so, we would never have known anything of Neptune. On one occasion, when Herschel was watching Uranus and tracing the course of its orbit, he found that his calculations did not check up correctly with the figures of earlier observations. Now, astronomers are not accustomed to be wrong in such matters, and when there are any discrepancies the first thing they do is to find out what is the matter. Let us see what they did. We get the story from Sir Robert Ball, Royal Astronomer of Ireland.

★ ★ ★

Bear in mind first that this matter of attraction among the planets is mutual. Of course, the sun's attraction is much stronger than any other forces. Nevertheless, it is true that not only does the sun pull the planets, but all the planets are pulling at each other. There is a constant struggle going on in the family party. Fortunately, the sun is so much more powerful than any other member that he keeps them all pretty well in order. So, if any one of them misbehaves in the least degree, there must be some real substantial reason for it.

★ ★ ★

The path of Uranus seemed simple enough. Jupiter gave it a pull here, and Saturn there, and it was thought that its whole course was explained by the action of these big, well-known planets. Then at one part of its orbit it was found that

Uranus went just a little astray from the spot where calculations indicated that it should be. It was evident to the astronomers that the planet could not have left its track of its own accord, and that there must, therefore, be some agency at work of which they were ignorant. What sort of a heavenly body could it be that was drawing Uranus away? The fixed stars were all too far off. They have nothing to say in the domestic matters of our little solar system. Two celebrated astronomers—Professor Adams of Cambridge, and Leverrier of Paris—set to work on this problem that had puzzled Herschel, and they performed an astonishing piece of experimental calculation. They figured out that *if a heavenly body of a certain size was in a certain position in the sky*, it would exert enough attraction on Uranus to draw it out of its course in just the manner that was puzzling them. They had to guess for awhile, but it was very intelligent guessing. Finally they determined on a planet of just the right weight and moving at the right speed to pull Uranus the way they had observed it to be pulled.

★ ★ ★

These two astronomers had now discovered a planet, but as yet it was only a planet on paper. Those that knew the exactness of science were confident that the planet was really in the sky, but they had not seen it yet. So Leverrier calculated that this planet, on a certain night in the autumn of 1846, should be in a particular spot in the sky, where it could be seen from some locality a little north of central Europe. Accordingly, he wrote to Dr. Galle, of the Observatory in Berlin, requesting him to point his telescope, on the evening in question, to the very spot indicated, and see if he did not discover there a planet that human eyes had never before observed. Of course Dr. Galle was delighted to undertake this marvelous commission. The evening was fine; the telescope was opened; it was directed toward the heavens; and there, in the very spot which the calculations of Leverrier had indicated, shone a beautiful planet. And they called it "Neptune."

W.D. Moffat





UNTIL March 15, 1917, Russia was officially a limited monarchy, but in reality an autocracy. The Imperial manifestoes still began with the form, "We, Nicholas II, Emperor and Autocrat of All Russia. . ." The officially limited monarchy was established in 1905, after the first Russian revolution, when the Constitutional Mani-

festo was promulgated on October 17 (30); until then Russia was an absolute monarchy.

Under the constitutional form of government, Russia was an Empire, at the head of which stood the Emperor, who also had the titles of the Tsar of All Russia, King of Poland, Grand Duke of Finland, and numerous other titles. All executive functions and, despite the Constitution, many legislative and judicial ones, were in his hands. He was also the head of the official Russian church.

The actual administration of the country was in the hands of several bodies. The most important of these was the Council of Ministers, consisting of heads of the various ministries and the more important departments. The Council was responsible to the Emperor, and consisted of the President, the Ministers of the Imperial Court, Foreign Affairs, War, Marine, Interior, Public Instruction, Finance, Justice, Agriculture, Ways of Communication, Commerce and Industry, the heads of the Departments of General Control and the Imperial Studs, and the Procurator of the Holy Synod. The promulgation and institution of laws was in the hands of the Ruling Senate, consisting of six departments. Thus the Senate served the purpose of the Supreme Court of Russia. The Church was administered by a body known as the Holy Synod.

The legislative powers were vested in the Douma and the Council of the Empire. The Douma consisted of 442 members, elected by indirect vote, the electoral rights being greatly curtailed by numerous qualifications. The Douma represented the people very unevenly. The Council consisted of 196 members, half of whom were appointed by the Emperor, and the other half were elected to represent the Church, the Universities, the nobility, etc. Members of the Douma were elected for five years, those of the Council for nine years, one-third being elected every three years. The legislative rights of the two chambers were identical with regard to the initiation of laws, questioning the ministers, etc. No bill could become a law without the approval of the Emperor.

The Revolution has so far changed nothing in the government of Russia, except eliminating the Emperor. The executive functions are now vested in the Provisional Government, which consists of the Council of Ministers, responsible to the Douma. Its orders are promulgated through the Ruling Senate. The perma-

nent form of government to be established in Russia now will be decided upon by the Constituent Assembly.

For purposes of local administration the Empire is divided into provinces, or *governments*, and territories. There are 78 provinces and 21 territories. These are subdivided into 777 districts, or *ouye'sds*. For purposes of partial self-government and land administration, the whole country is divided into 17,075 smaller districts, variously called the *volost*, the *gmina*, the *stanitsa*, etc., the officials of which are elected by delegates of village communities. The officials of the village communities are elected by the peasants themselves in their village assemblies, known as the *mir* (meer). The administration of local economic, sanitation and similar local affairs in the *governments* and the districts is partially in the hands of the *zem'stvos*, or district and provisional assemblies, elected by peasants, householders in towns, and landed proprietors. Municipalities have a certain degree of self-government.

The system of judiciary established by the law of November, 1864, provided for assize courts with juries, for elective justices of peace (elected by the nobility), for assemblies of such justices, where appeals from the decisions of separate magistrates could be heard, and for special appeal courts to hear cases not tried by juries. The highest court of appeal was to be the Senate. This system has not been preserved in its entire excellent scope. There have been especially numerous and grievous abuses in connection with the principle of the irremovability of the examining magistrates, which was not followed at all in late years.

Education in Russia is in a backward state; almost three-quarters of the population are illiterate. In 1912 (the latest figures available) there were in Russia 130,088 schools with a total attendance of 8,471,952. Only about fifty persons out of every thousand of the population attended schools, and but about one-sixth of the total number of children of school age were receiving education. In the whole country there were 56 higher institutions of learning, which enrolled 68,671 persons. In the course of the past five years the advance in education has been marked, though still insufficient. There are over three thousand periodical publications in Russia. Over thirty-two thousand books and pamphlets are published in Russia annually, which is more than one-fifth of the total number of books and pamphlets published in the world.



PETROGRAD is a made-to-order city. At one time its site was a practically uninhabited marsh; it was due to Peter the Great that this magnificent city, now the capital of Russia, stands there in its glory today. In the seventeenth century the land thereabout belonged to Sweden; but in 1700 Peter the Great of Russia began

his wars with that country, and three years later he captured the Swedish fortress on the River Neva (Russian, neh-vah'; English, nee'vah). He planned immediately to build a mighty capital there, and on June 29, 1703, he laid the foundations of a cathedral to St. Peter and St. Paul, and of a fort that received his own name. The buildings of this newly founded city had to rest on piles, for the ground was marshy. The Tsar removed thousands of people from all parts of Russia thither to help in erecting the fortress and building houses. Many of these died there.

This city was called St. Petersburg. The population did not grow very fast, however, and under later rulers compulsory measures were used to raise the population; at the same time many beautiful and imposing buildings were erected.

St. Petersburg soon became the export harbor for more than half of Russia. The city has also played a prominent part in the development of Russian thought, and it has helped to familiarize the Russian public with the teachings of western Europe. At the beginning of the present war, the name of St. Petersburg was changed to Petrograd.

The main part of Petrograd stands on a peninsula formed by the River Neva before it enters the Gulf of Finland. This river is crossed by three fine permanent bridges and one which, being built on boats, is removed during the autumn and spring. In winter, when the Neva is covered with ice two or three feet thick, temporary roadways for carriages and pedestrians are made across the ice and artificially lighted. The Neva is frozen from about November 25th to April 21st, but it is unnavigable for some time longer.

The climate of Petrograd is changeable and unhealthy. The winters are cold and the summers are short and hot.

The expanse of the city is wide, and its population is dispersed. Its topography is very simple. Three long streets, the main arteries of the city, radiate from the Admiralty Building, which is surrounded by a broad square, called the Alexander Garden. These three streets are called the Neva Prospect, the Goro'khovaya, and the Ascension Prospect. Three girdles of canals, roughly concentric, intersect these three streets—the Moika (moy'ka), the Catherine and the Fontanka (fontahn'-kah). To these canals a number of streets run parallel.

The Neva Prospect is a world famous street. It is always crowded, day and

night. It is a very broad, beautiful avenue. The buildings that border it, however, are architecturally poor; but it is gay with promenaders, and its shops are picturesque and attractive.

The churches of Petrograd are among its most interesting features. The Cathedral of St. Isaac is remarkable for its rich severity. This cathedral stands in the Alexander Garden. The main cupola of St. Isaac's and its surmounting lantern and cross are overlaid by two hundred pounds of gold leaf. Just across the square from the cathedral is the statue of Peter the Great, which was presented to the city by Catherine II.

The Cathedral of the Virgin of Kazan (kah-zahn'), a rather ugly imitation on a small scale of St. Peter's in Rome, stands on the Neva Prospect. From the year 1811 the royal family were accustomed to give thanks in this cathedral for victories or delivery from danger.

The fortress of St. Peter and St. Paul, founded by Peter the Great, contains within its walls a cathedral, which is the burial place of all the sovereigns who have since sat on the throne of Russia, with the exception of Peter II, who died in Moscow. Opposite this fortress, facing the River Neva, on Vasilyevskiy (vahsil'yevsky) Island, stands the Winter Palace. This was so named in contrast to the summer home of royalty, which used to be on the Fontanka Canal. The huge structure of red stucco is capable of housing six thousand people. The Hermitage adjoining it is a treasure house of antiquities, paintings and sculpture.

The population of Petrograd is over two million. A very high proportion of its people live on their own earnings; there are comparatively few who are dependent. Six railways meet at the city; the River Neva is the principal channel for trade of Petrograd with the rest of Russia.

The University of Petrograd exercises a strong influence on the life of the city, in spite of the fact that formerly it was subjected to many hardships and persecutions. Nearly four thousand students were usually in attendance there.

Petrograd is less of a manufacturing city than Moscow or Berlin. It is, nevertheless, the chief city of one of the foremost industrial provinces in Russia. Its chief manufactures are cotton, metal works, tobacco, paper, soap, ships, sugar, pottery and chemicals. Its export trade is chiefly in grain.





It has been often said that Petrograd is the head of Russia and Moscow is its heart. By this is meant that while Petrograd leads in thought, Moscow takes first place in industry and commercial activity. Moscow is one of the most material of cities. Moscow is situated on both banks of the River Moskva (mosk-vah'), about four hundred

miles by rail from Petrograd. In the year 1520 it was said to contain one hundred thousand inhabitants. During the whole of the seventeenth century Moscow was the scene of many troubles and internal struggles. Peter the Great, because of the opposition encountered at Moscow to his plans of ruling Russia according to his idea of military autocracy, left the city to found a new capital, which later became the city of Petrograd. In the course of the eighteenth century Moscow became the seat of a discontented opposition to the Government at Petrograd. When Napoleon captured the city in 1812, it was set on fire by its own inhabitants. Moscow was then pillaged by the French troops. The burning of the city became the signal for a general rising of the peasants against the French. Napoleon was compelled to abandon Moscow.

The present city covers an area of about thirty-two square miles. In the center, on the left bank of the River Moskva, stands the Kremlin. This is a famous old stronghold, nearly triangular in shape, about one hundred acres in extent, and occupying a hill one hundred and thirty feet above the river. It is enclosed by a high stone battlemented wall, 2,430 yards in length and having nineteen towers. Of all the sacred places within the Kremlin, the most venerated is the Uspen'sky Cathedral. It contains the oldest and most venerated holy pictures in Russia, and numerous relics of saints. The Russian tsars after Ivan IV were consecrated in this cathedral. The Archangel Cathedral on the opposite side of the square contains the tombs of the rulers of Russia from Ivan Kalita (Kahlita') (1340) to Ivan Alexeyevich (1896) and possesses vast wealth. One of the most famous of the bell towers in the Kremlin is that of Ivan Veliky (Vel'ekiy), erected by the Tsar Boris Godunov in 1600, and rising to the height of 271 feet. It contains many bells. Close by is the well-known King of Bells, which is sixty-five feet in circumference around the rim,

nineteen feet high, and weighs one hundred and ninety-eight and one-third tons. This bell was cast in 1735, and was broken during the fire of 1737 before being hung.

The Great Palace of the tsars, erected in 1838-1849, also stands in the Kremlin. It is a fine building in white stone, with a gilded cupola. One of the largest and most beautiful of all kingly apartments is the Golden Hall of St. George in this palace. The left wing of the Great Palace contains the armory and the treasury.

The Kitay-Gorod (keetahy'-Go'rod), which covers one hundred and twenty-one acres, is the chief commercial quarter of Moscow. The Red Square, which is nine hundred yards long, with a stone tribunal in the middle, a market cross and a place of execution, separates this quarter from the Kremlin. At its lower end stands the fantastic Pokrov'sky Cathedral (usually known as Vasily Blazhennyi) (vah-see'lee blazhzen niy), one of the wonders of Moscow, because of its towers, differing from each other, and representing in their variety of colors pineapples, melons, and the like. It was begun by Ivan the Terrible in 1554 to commemorate the conquest of Kazan. In this quarter also stands the House of the Romanovs. Here was born the first of the Romanov family, until recently the reigning family of Russia.

The climate of Moscow is healthy. The summer is warm and the winter cold and dry. The population of the city is over 2,000,000. It is an important commercial city. Here is centered the traffic in grain, in hemp and in oils sent to the Baltic ports. Some of the other products in which the merchants of the city deal are tea, sugar, tallow, wool, metals, wine and silk. It is also a manufacturing city, the center for cotton goods. Moscow has many educational institutions. The University, founded in 1755, is one of the most largely attended in Russia. Its students number over five thousand. Moscow is surrounded by beautiful parks and picturesque suburbs.





IEV (kee'yehv) was the capital of the Cossack Kingdom. Its story is closely connected with the story of Russia. According to legend, the city was founded in 864 by three brothers named Kiy (keey), Shchek, and Khoriv, who named their settlement after the oldest. Standing like a Gibraltar of the prairies, Kiev has always been

the object of combat. After the deaths of the three founders, the principality was seized by the Varangians (Scandinavians). In 882 Kiev was conquered by a ruler named Oleg (Ohleg'). Tartar Khans, Lithuanian Princes and Poles have in turn fought for the city. In 988 Prince Vladimir, the first saint of the Russian church, caused his people to be baptized in the waters of the Dnieper, opposite the town; and Kiev became the seat of the Christian church, of the first Christian school and of the first library in Russia. For 376 years Kiev was an independent Russian city; from 1240 to 1320 it was subject to the Mongols; from 1320 to 1569 it belonged to the Lithuanian principality; and from 1569 to 1654 it belonged to Poland. The city was finally united to the Russian Empire in 1686. It was the most important city after the decline of Novgorod. In 1840 Kiev was made subject to the common civil law of the Russian Empire.

Kiev is 628 miles by rail southwest of Moscow and 406 miles by rail northeast of Odessa (o-dess'ah). The city is located on the west bank of the river Dnieper, and the site of the greater part of the town consists of hills or bluffs, separated by ravines and hollows. On the opposite side of the river the country spreads out low and level. The Dnieper is here a broad and navigable stream, but as it approaches the town it divides into two arms and forms a low, grassy island of considerable extent called Tukhanov (toughah'nov). At the southern part of the town, the two streams reunite. Steamers go up and down the Dnieper; and altogether Kiev is one of the most picturesque cities in Russia.

The Old Town, or Starokievskaya Chast (stahrokiyev'skaya chahst) as it is called, occupies the highest range of hills. The houses are built closely together, and mostly made of stone. Many of the buildings are modern. The church of St. Andrew the Apostle stands where according to Russian tradition that apostle stood before the founding of Kiev and declared that the hill would become the site of a great city. The present building dates from 1744-1767.

The lower part of Kiev is the commercial district. This quarter is called the Podol (po-dole'). Here every February is held the Stryetensk (stryeh'tensk) Fair. The traffic in sugar is its most important feature, although business men, farmers and manufacturers also meet to make con-

tracts for delivery of every kind of merchandise. During the three weeks of the fair the sales amount to about one million dollars.

The southeastern district of Kiev is called Pechersk (Pyechehrsk'), from the Russian word *peschera* (pyeh'shehera), meaning a cave. This name comes from the caves or catacombs in the monastery located in that district, called the Kiev-Pechorskaya Lavra. This monastery is the chief of its kind in Russia, and is visited every year by about 250,000 pilgrims.

In the New Buildings are the university and the botanical gardens. The educational and scientific institutions of Kiev rank next to those of Petrograd and Moscow. The population of Kiev is over 500,000.

Odessa, which is one of the most important seaports of Russia, and is situated at the northwest angle of the Black Sea, is the real intellectual and commercial capital of the so-called Novorossia (no-voross'iyah), or New Russia. It is by rail about a thousand miles south-southwest of Moscow, and about 406 miles southwest of Kiev. In appearance it is the least Russian of all the cities of the country. The inhabitants are to a great extent foreigners.

The Bay of Odessa was colonized by the Greeks at a very early period. In the fourteenth century the region belonged to the Lithuanians. These people, and afterward the Poles, kept the country under their dominion until the sixteenth century, when it was seized by the Tartars. In 1789 the Russians captured the fortress that the Turks had erected there, and in 1791 the region was ceded to Russia. In 1824 Odessa became the seat of the governors-general of Novorossia and Bessarabia (bes-a-rah'bih-yah). During the years 1905-1906 the city was the scene of violent revolutionary disorders, marked by a naval insurrection.

Odessa has the appearance of a wealthy west European city. The Nikolai (nick-o-ly) Boulevard is a fine promenade. The central square contains a statue erected in 1826 of Armand, Duc de Richelieu (French, reesh'ly-eh; English, reesh'loo), who was the first governor of Odessa, from 1803 to 1814. From this monument a magnificent flight of nearly two hundred granite steps leads down to the harbor.

The population of Odessa is over 600,000. It has a university with about 1,700 students.



THE Volga (vol'gah) is by far the longest river in Europe; it is also the most important river of European Russia. It rises in the Valdai (vahl'dy) Plateau of Tver (tvair) in Russia, and after a winding course of 2,325 miles, falls into the Caspian Sea at Astrakhan (ahs-trah-kahn'). The Danube, which comes next

to the Volga in length, is only 1,775 miles long, while the Rhine, 760 miles, is shorter even than two of the chief tributaries of the Volga—the Oka (o-kah') and the Kama (kah'mah). The drainage area of the Volga, which includes the whole of the middle and eastern, as well as part of southeastern Russia, amounts to 563,300 square miles and contains a population of fifty millions of people. By a system of canals, which connect the upper Volga with the Neva, the city of Petrograd has become the chief port of the Volga basin.

The Russians speak of this river as Mother Volga, and it is a subject of many songs and fables. It has carried the cargoes of a greater number of nations than any other river. Until late years it was the main highway for the commerce of the East with Russia. Like the Mississippi River, the Volga is shallow, broad, brown and crooked.

The Volga, rising in extensive marshes on the Valdai Plateau, first traverses several small lakes and then Lake Volga, later on being joined by the Sheksna (sheks'nah) River. From there the Volga flows toward the southeast, past Yaroslavl (yah-ro-slahvl') and Kostroma (kos-tromah'), along a broad valley. The next great tributary is the Oka, which comes from the southwest.

At this confluence stands Nizhny-Novgorod (neezh'ni-nov'go-rod). This city, which has a population of about 108,000, is 272 miles by rail east of Moscow. Its position is very important commercially, and because of this it has become the seat of the famous Makaryevskaya (mah-kar'yev-skaya) Fair. This fair is so called because it used to be held at Makaryev (mah-kah'ree-ehv). It was transferred to Nizhny in 1817, because the shops at Makaryev had been destroyed by fire. The fair is held from July 29 to September 10. The goods dealt in are cotton, woolen, linen and silk stuffs, in addition to many other wares. The total sales and orders amount to about sixty-five million dollars annually, and about four hundred thousand people from all parts of Russia and Asia attend it.

As early as the eleventh century the Russians founded a fort twenty miles above the confluence of the Oka and the Volga. In 1221 a fort was erected on the hill now occupied by the Kremlin of Nizhny. The town grew rapidly, enjoying almost complete independence until 1390,

when Prince Vasily of Moscow took Nizhny and established his own government there. In 1417 it was definitely annexed to Moscow. The second half of the sixteenth century was for the city a period of rapid development. In 1667 the robber chief-tain Stenka Razin (stehn'ka rah'zeen) made an unsuccessful attempt to capture the city. At one time Nizhny had two academies, and its theater also was of some importance in the history of the Russian stage.

Nizhny-Novgorod consists of three parts: the upper city, including the Kremlin; the lower town or Nizhny Bazaar; and the Fair, with the suburb of Kunavino (koonah'vino). The upper city is built on three hills, above the right banks of both the Oka and the Volga. The Kremlin or old fort occupies one of these hills, facing the Volga. Five descents lead from this part of the city to the lower-town. Here are the wharves and the great storehouses. The railway from Moscow has its terminus close to the Fair buildings. To the south of this is the suburb of Kunavino, widely known throughout the East as a place for amusements of the lowest kind during the fair. The climate of the city is harsh, its yearly average temperature being 39°.

Some distance below Nizhny, the Volga is joined by the Sura (soo'rah) River and sometime afterward passes Kazan, the ancient capital of the Tartars. Then the River Kama joins the Volga. Along the next 738 miles of its course, the Volga flows south-southwest, with but one great bend at Samara (sah-mah'rah). At this point the river is very picturesque, fringed by cliffs which rise one thousand feet above the level of the river. At Tsaritsyn (tsahr-itz'in) the river takes a sharp turn in a southeasterly direction toward the Caspian Sea. The river widens below this point, ranging from 520 to 3,500 yards in width and with a depth exceeding eighty feet. The delta of the Volga begins forty miles above Astrakhan, and the branches of the Volga subdivide so as to reach the sea by as many as two hundred separate mouths. Below Astrakhan navigation is difficult, and on the sandbars at the mouth of the river the maximum depth is only twelve feet in calm weather.

Astrakhan is interesting because the Caspian is one of the largest inland sea fishing grounds. The sturgeon is the most valuable product. From here, therefore, comes the greater part of Russian caviare.





SIBERIA is a big place. This may very easily be seen if one takes a map and traces out its boundaries. Siberia is bounded by the Ural (oo-ral') Mountains on the west, by the Arctic and Pacific oceans on the north and east respectively, and on the south by a line running from the sources of the River Ural to the Tarbagatai (tahr-bah-gah-ty') Range, thence along the Chinese frontier as far as the south-east of Transbaikalia (trans-by-kah'tih-ah), and then along the rivers Argun (ahr-noon), Amur (ah-moor') and Usuri (oo-ssoo'riy) to the frontier of Korea. This area is divided into West Siberia and East Siberia.

In the sixteenth century the Russian name Siber (see-beer') indicated the chief settlement of the Tartar khan Kuchum-Isker (koo-choom' ee-sker) on the Irtysh (Russian, ir-tish; English, ir'tish). Afterward this name was extended to include the whole of the Russian dominions in Asia.

The earliest inhabitants of Siberia were called the Yeniseians (yeh-neese'yens), and a few traces of them still remain among the Sayan (sah-yan') Mountains. These people were followed by the Ugro-Samoyedes (oog'ro-sah-mo-yed'), who probably came to Siberia during the great migration of the Huns in the third-century B. C. Iron was unknown to these people, but they were excellent workers in bronze, silver and gold. Their civilization seems to have stood comparatively high. Eight centuries later they were subdued by the Khagases (khah-gas') and Ugurs (oo'ih-goorz'). They were acquainted with iron, and also were skilled workers in pottery. Afterward they were conquered by the Mongols. The Russians arrived in Siberia toward the close of the sixteenth century. Bands of hunters and adventurers every year poured into the country, advancing eastward and erecting forts as they went. Within eighty years the Russians had reached the River Amur and the Pacific Ocean. The country was then explored and opened up to a certain extent during the year following.

The climate of Siberia is extremely severe in the northern parts. There during the winter the temperature sometimes is as low as 61° below zero. However, during the short summer the days are long and even hot. More dreaded than the frosts are the *burans* (boo-rahns'), or snow storms, which come in the early spring and destroy thousands of horses and cattle. In April spring sets in, but in the last part of May come what are called the "icy saints' days." Following these, summer comes in its full beauty.

The population of Siberia—only estimated, of course—is about seven millions. This population is greatly scattered, so that the density averages only about 1.2 persons to a square mile. The great bulk of the population are Russians; and very few of the inhabitants live in cities. As a rule the Russians intermingle to a certain extent

with the other races, but in West Siberia there exist compact masses of Russians.

In Siberia there are but seventeen cities with a population of ten thousand or more. The largest cities in the country are Tomsk (tomsk), with a population of about sixty-four thousand, and Irkutsk (ir-kootsk'), with a population of about fifty thousand—the capitals of West and East Siberia respectively.

Education stands at a very low level. Agriculture is the chief occupation of the inhabitants. Hunting and fishing are also profitable occupations. Although Siberia has within itself all the raw material necessary for prosperous industries, it imports from Russia all the manufactured articles it uses. Because of this, these articles are very expensive.

For many years Siberia was a penal colony. Exile to Siberia began in the first years of its discovery. Until the discontinuance of the system after the revolution of 1917, an average of twenty thousand prisoners were annually exiled to Siberia. After liberation, some of the convicts settled in villages. About twenty thousand men are still in Siberia leading the life of *brodyagi* (brodya'gi) (runaways or tramps), and striving to get back through the forest wilderness to their homes in Russia.

Travel in Siberia to a certain extent is carried on by means of the navigable rivers. Another lane of communication is the great Moscow Road, which starting from Perm (perm) and crossing the Ural Mountains, reaches Ekaterinburg (eh-kaht-teh-reen-boorg'), the center of the mining industry, and Tyumen (tyoo-men'). From Tyumen the road proceeds to Irkutsk and thence finally to Stryetensk (strye'tensk).

The first railway to reach Siberia was built in 1878, when a line was constructed between Perm and Ekaterinburg on the eastern slope of the Ural Mountains. In 1884 this line was extended as far as Tyumen, the head of navigation on the Siberian rivers. It was supposed at that time that this line would form a part of the projected trans-Siberian railway. In 1885, however, it was finally decided to give a more southerly direction to the railway.

The trans-Siberian Railway, the first section of which was opened in December, 1895, runs across Siberia from Vladivostok (vlah-dee-vos-tock') to Russia, extending as far as Moscow and Petrograd. Its total length is nearly 5,500 miles.

Siberia will receive full description and illustration in a later member of The Mentor.